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ABSTRACT

This document provides eleven year trend data of physics and astronomy degrees granted at the bachelors, masters, and doctors level. Undergraduate and graduate student enrollment in physics and astronomy are also included. (SL)

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AIP report

MANPOWER STATISTICS DIVISION

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ENROLLMENTS AND DEGREES

AIP Pub. No. R-151.14

by Susanne D. Ellis

June 1977

The annual AIP Survey of Enrollments and Degrees was started in 1960 and has the distinction of summarizing the data from nearly 100% of the physics-degree-granting institutions. In 1972 the survey was expanded to include separate astronomy departments. Thus, each winter approximately 900 chairmen contribute data on their departments' current enrollments and the previous year's degrees to provide the base for this summary report.

Eleven year trends of physics degrees granted at the three levels—bachelor's, master's, doctor's—are shown in **Figure I** and include the peaks reached between 1969 and 1971. Although the total number of physics degrees conferred each year continues to decline, it does so at a decreasing rate; for the class of 1976 the percentage decline was less than 2% for the bachelor's degrees, and less than 5% for both master's degrees and doctorates.

The master's degrees shown in **Figure I** include both terminal master's degrees and those conferred enroute to a higher degree; it is the latter group that has leveled off just above 800 while the terminal master's degrees continue to decline. Both bachelor's degrees and doctorates are expected to level off at 4500 and 1000 respectively.

Fig. I: Physics degrees awarded by academic year 1966-76

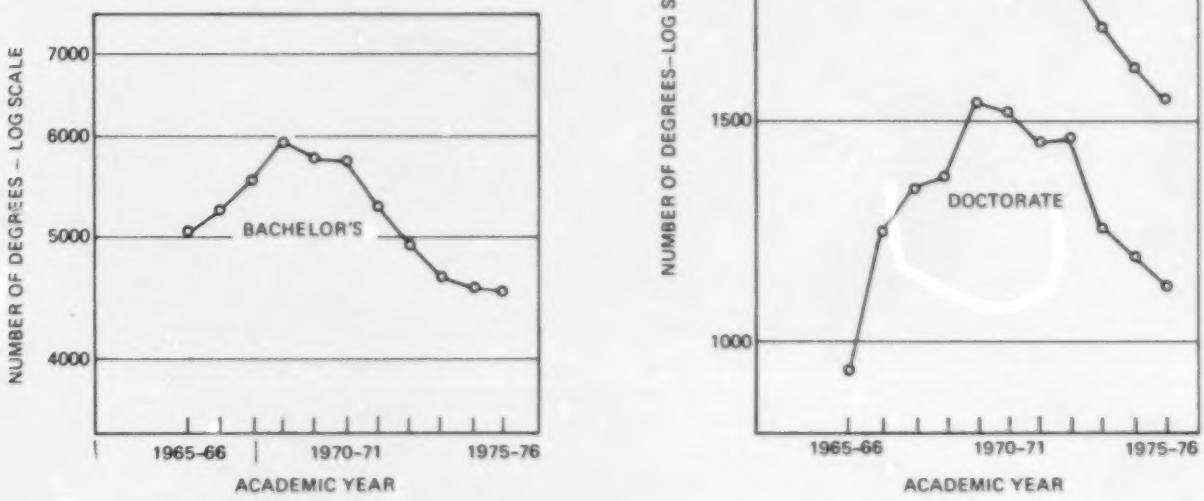

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Table I. Physics enrollments and degrees awarded by academic year 1967–77

Academic year	Number of physics degrees granted (July 1 to June 30)			Undergraduate physics-major enrollment		Graduate physics-student enrollment	
	Bachelor's	Master's	Doctorate	Juniors	Seniors	Total	1st year*
1967–68	5522	2077	1325	7822	6704	15305	4010
1968–69	5975	2223	1355	7587	7019	15475	3669
1969–70	5782	2268	1545	7480	6700	14372	3918
1970–71	5755	2300	1530	6884	6663	14327	3494
1971–72	5282	2143	1438	6593	6162	13276	3336
1972–73	4923	1961	1445	6012	5806	11804	2904
1973–74	4652	1772	1236	5858	5108†	11119	2680
1974–75	4571	1650	1167	5660	4909†	10410	2668
1975–76	4487	1570	1111	5888	4922†	10372	2646
1976–77				5711	4930†	9991	2624

* *Includes part-time students who might be at the 1st-year level for more than one year.*

† *This total has been adjusted by 500 for students who are seniors for more than one year.*

Table I presents the numerical data for most of the points on the three graphs in **Figure 1** in addition to ten-year trends in undergraduate and graduate physics enrollments. It is important to call attention to the leveling-off of the first-year graduate physics students between 2600 and 2700, down almost 40% from its largest total of 4358 recorded twelve years ago.

Table II traces each graduating class of physics bachelors back to the number of matriculated male freshmen who enrolled four years earlier. In recent years the numbers of senior physics majors reported by some chairmen appeared to be unusually large when compared with the number of bachelor's degrees granted by those departments annually. To understand this discrepancy we conducted a special survey the results of which indicated a change to part-time status for approximately 1000 seniors in 60 physics departments; these students, the chairmen explained, were given senior status for more than one year and consequently were reported as seniors repeatedly. The reason why senior-level physics majors switch to a part-time status is generally a part-time industrial employment offer. Thus, starting with the class of 1974 the figures for the number of seniors were reduced by 500 thereby changing an apparent 4–8% attrition to a 13–15% attrition between the beginning of the junior and senior year. By the end of the senior year less than 80% of the juniors remain to receive their bachelor's degrees.

Table III is an expanded version of **Table I**; it divides each enrollment and degree total into two or three parts according to the types of institutions associated with those enrollments and degrees. Thus shifts in enrollments among types of institutions can be identified as they occur. A recent shift appears to be away from the master's-granting institutions and involves both undergraduate and graduate students.

Table II. A comparison of undergraduate physics majors* and degree recipients with corresponding total male freshmen classes—1970 to (projected)† 1979

Graduating class**	Number of males enrolled as freshmen #	Junior physics majors		Senior physics majors		Physics bachelor's degrees awarded	
		Number	Percentage of males enrolled as freshmen	Number	Expressed as % of those enrolled as juniors	Number	Expressed as % of those enrolled as juniors
1970	555 000	7587	1.37	6700	88	5782	76
1971	548 000	7480	1.36	6663	89	5755	77
1972	591 443	6884	1.16	6162	90	5282	77
1973	608 089	6593	1.08	5806	88	4923	75
1974	608 823	6012	0.99	5108‡	85	4652	77
1975	585 393	5858	1.00	4909‡	84	4571	78
1976	560 035	5660	1.01	4922‡	87	4487	79
1977	562 324	5888	1.05	4930‡	84	4600	78
1978	585 923	5711	0.97	4870	85	4500	79
1979	598 388	5700	0.95	4900	86	4500	79

* *Almost 9% of the physics majors are women.*

** *Each row in this table follows a graduating class through college.*

\# *"Projections of Educational Statistics to 1984–85" published by the National Center for Educational Statistics in the spring of 1977.*

† *All data under the dotted line are projected.*

‡ *This total has been adjusted by 500 for students who are seniors for more than one year.*

Table III. Undergraduate and graduate enrollments and degrees by institution type*, 1976–77

Academic year	Number of physics degrees granted (July 1 to June 30)			Undergraduate physics-major enrollment		Graduate physics-student enrollment	
	Bachelor's	Master's	Doctorate	Juniors	Seniors **	Total	1st year
				Doctorate granting institutions			
1967–68	2816	1676	1325	3982	3322	13505	3251
1968–69	2994	1850	1355	3794	3699	13633	2998
1969–70	3036	1804	1545	3869	3369	12779	3202
1970–71	2868	1817	1530	3510	3450	12400	2658
1971–72	2502	1640	1438	3082	2987	11434	2449
1972–73	2265	1484	1445	2787	2717	10227	2177
1973–74	2155	1387	1236	2844	2484	9759	2169
1974–75	2191	1318	1167	2780	2420	9295	2205
1975–76	2182	1249	1111	2983	2505	9241	2163
1976–77				2862	2502	8867	2183
				Master's granting institutions			
1967–68	1016	401		1411	1239	1800	759
1968–69	1029	373		1335	1270	1842	671
1969–70	1022	464		1281	1274	1593	716
1970–71	1044	483		1220	1175	1927	836
1971–72	982	503		1238	1210	1842	887
1972–73	820	477		1145	1086	1577	727
1973–74	810	385		939	893	1360	511
1974–75	699	332		881	741	1115	463
1975–76	604	321		916	811	1131	483
1976–77				846	761	1078	443
				Bachelor's granting institutions			
1967–68	1690			2429	2143		
1968–69	1952			2458	2050		
1969–70	1724			2330	2057		
1970–71	1843			2154	1998		
1971–72	1798			2273	1965		
1972–73	1838			2080	2003		
1973–74	1687			2075	1731		
1974–75	1681			1999	1748		
1975–76	1701			1989	1606		
1976–77				2019	1667		

** *These are senior physics major enrollments as of September. The last four years of totals have been adjusted for part-time seniors who would otherwise have been counted as seniors for more than one year.*

Table IV. Introductory physics enrollments at physics degree-granting institutions by geographic region, 1974–77

Geographic Region†	1974-75			1975–76			1976–77		
	Institution type*			Institution type*			Institution type*		
	I	II	III	I	II	III	I	II	III
New England	4076	1660	14743	3696	1179	17250	4160	1910	17069
Mid. Atlantic	11903	5901	23848	15201	4056	28604	13011	4390	27518
E.N. Central	10368	12782	25993	12757	12052	27603	13020	10773	26330
W.N. Central	6098	3731	9990	6450	4931	10025	6053	3395	12570
S. Atlantic	8478	4365	22270	9325	5279	22410	10208	4474	21590
E.S. Central	3060	2702	8119	3237	3458	7948	4169	1857	8874
W.S. Central	4459	6774	14935	6109	6931	17049	5957	9997	17002
Mountain	3102	894	14871	3052	955	14709	2618	937	15231
Pacific	8993	6261	17556	9074	6680	18498	6910	8009	19709
Subtotal	58537	45070	152325	68901	45521	164096	66106	45742	165893
Total		255932			278518			277741	

* *"Institution type" indicates the highest physics degree offered; type I = bachelor's degree, type II = master's degree, type III = doctorate.*

† New-England-*Conn., Me., Mass., N. Hamp., R.I., Vt.;* Middle Atlantic-*N.J., N.Y., Pa.;* East North Central-*Ill., Ind., Mich., Ohio, Wisc.;* West North Central-*Iowa, Kansas, Minn., Mo., Nebr., N. Dak., S. Dak.;* South Atlantic-*Del., D.C., Fla., Ga., Md., N.C., S.C., Va., W.Va.;* East South Central-*Ala., Ky., Miss., Tenn.;* West South Central-*Ark., La., Okla., Tex.;* Mountain-*Ariz., Colo., Idaho, Mont., Nev., N. Mex., Utah, Wyo.;* Pacific-*Alas., Cal., Hawaii, Oreg., Wash.*

Table V. Introductory physics enrollments, 1976–77

Enrollment in introductory physics courses designed for		Institution type* I N	I %	II N	II %	III N	III %	Total N	Total %
engineering majors		13221	20	10978	24	60052	36	84251	30.3
physical science majors		11899	18	5489	12	23723	14	41111	14.8
biology, health-related majors		21815	33	15095	33	47280	29	84190	30.3
others		19171	29	14180	31	34838	21	68189	24.6
Total introductory enrollment	N	66106	100%	45742	100%	165893	100%	277741	
	%	23.8		16.5		59.7			100%

* *"Institution type" indicates the highest physics degree offered; type I = bachelor's degree, type II = master's degree, type III = doctorate.*

When compared with other disciplines such as chemistry, engineering or the social sciences, physics attracts a relatively small number of students to major in it; however, introductory physics courses enroll one quarter of the one million freshmen who enter the 4-year colleges and universities as degree-credit students each fall. **Tables IV** and **V** present the distribution of these introductory physics students geographically, by type of institution and by design of courses. The three-year trend shown in **Table IV** indicates a 9% increase between 1974–75 and 1975–76 and a leveling-off at an enrollment of almost 280,000 students.

Table V summarizes the answers to a new question: each chairman was asked to classify the introductory physics courses according to design for specific majors and report the enrollment for each category. The category "other" listed in the first column includes for the most part those institutions that offer only one introductory course and students enroll in it irrespective of intended major. A noteworthy feature of **Table V** is that the total number of prospective engineering majors is very similar to the number of biology and health-related majors who take introductory physics, but a higher proportion of the engineering majors study at doctorate-granting institutions, whereas 22,000 biology and health-related majors compared with only 13,000 engineering majors are enrolled in the 4-year colleges.

In these years of declining enrollments physics department chairmen called attention to requests for special courses that attract more students each term than the physics departments are able to accommodate. These courses are described as connecting physics with a humanity, art, or society and frequently have few or no prerequisites. Our 1976–77 questionnaire asked each chairman to list the course title(s) and enrollments. Thus almost 700 departments contributed to a list of special courses with titles ranging from "Physics of Perception and Aesthetics" to "Rainbows and Radio-dials".

To major in physics is generally a decision students make when they are freshmen even though the universities do not require students to declare a major until the beginning of the junior year. For that reason the number of freshmen and sophomores presented in **Table VI** include estimates by some chairmen, whereas junior and senior totals are more reliable figures.

Table VI. Undergraduate physics majors by type of institution and geographic region, 1976–77

Geographic region†	Estimated ** no. of freshmen			Estimated ** no. of sophomores			Number of juniors			Number of seniors		
	Institution type*			Institution type*			Institution type*			Institution type*		
	I	II	III	I	II	III	I	II	III	I	II	III
New England	172	31	427	172	35	417	141	32	410	128	36	390
Mid. Atlantic	528	182	656	479	137	605	362	132	535	315	108	421
E.N. Central	534	291	465	453	283	382	378	178	342	331	152	348
W.N. Central	415	118	165	362	86	165	264	90	181	212	91	145
S. Atlantic	465	136	458	359	115	365	287	107	375	223	98	296
E.S. Central	144	90	101	133	72	100	105	54	69	92	38	94
W.S. Central	297	115	255	224	92	229	175	76	203	138	72	174
Mountain	92	26	358	79	17	262	48	13	244	47	12	211
Pacific	301	122	508	274	123	458	243	164	503	181	154	423
Subtotal	2984	1111	3393	2535	960	2983	2003	846	2862	1667	761	2502
Total		7452			6478			5711			4930	

* *"Institution type" indicates the highest physics degree offered; type 1 = bachelor's degree, type II = master's degree, type II = doctorate.*
** *Estimates made by the physics department chairmen.*
† *See Table IV for explanation of geographic region.*

Table VII. Full-time and part-time graduate physics enrollment by type of institution 1972–77.

Academic year	Number of first-year graduate students			Total number of graduate students						
	Institution type*			Institution type*						
	II	III	Total	II			III			
				Full-time	Part-time	Sub-total	Full-time	Part-time	Sub-total	Total
1972–73	727	2177	2904	763	814	1577	9178	1049	10227	11804
1973–74	511	2169	2680	734	626	1360	8810	949	9759	11119
1974–75	463	2205	2668	623	492	1115	8326	969	9295	10410
1975–76	483	2163	2646	628	503	1131	8439	802	9241	10372
1976–77	442	2182	2624	576	507	1083	8119	789	8908	9991

** Institution type indicates the highest physics degree offered type II = master's degree type III = doctorate.*

The shift in enrollment toward the doctorate-granting institutions is shown again in **Table VII.** As the total number of first-year graduate students levels off, the PhD-granting institutions report a slight increase in first-year graduate students while the master's-granting institutions show a 10% decrease from the previous year. Unlike other disciplines, physics has a large proportion of full-time graduate students, namely 84–87%; however, the master's-granting institutions which account for 11–13% of the graduate physics enrollment report that almost half of their students study on a part-time basis.

The number of physics doctorates granted each year has correlated well with the number of first-year graduate students who enrolled at doctorate-granting institutions five years earlier. The median time-lapse between the bachelor's degree and the doctorate in physics is between five and six years with a range from less than three to more than ten years. To arrive at the projections of physics doctorates shown in **Figure II** we examined both a five-year and a six-year time lapse and found a better correlation when the five-year time lapse was used. Thus when the number of first-year graduate students at PhD-institutions is 2500 or more, 44% of them eventually get the PhD. But as this number of first-year graduate students drops to around 2200, it probably includes a larger proportion of the committed students; hence one could expect a slightly higher percentage of them to attain a doctorate five years later. The number of first-year students has leveled-off, as shown in **Table III**, hence we expect the number of doctorates to level-off by 1977 and remain just under one thousand for about five years.

Figure II: Actual and projected number of physics doctorates granted 1964–1981

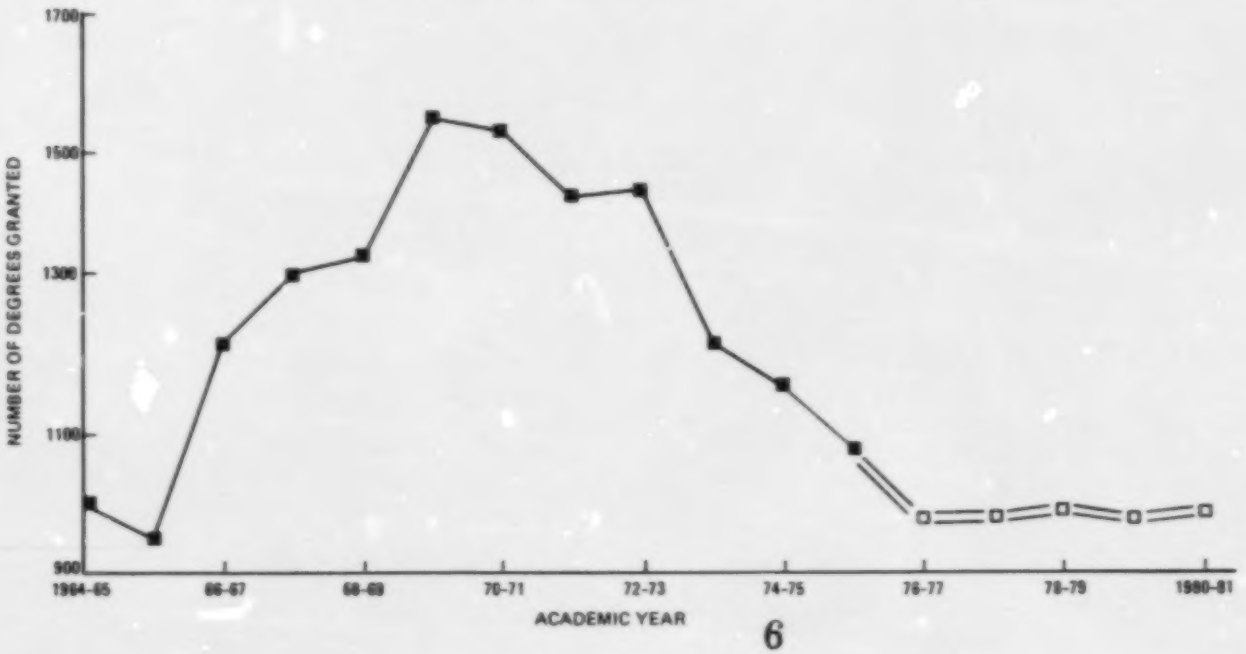

Table VIII. Physics degrees, by type of institution and geographic region, 1975-76.

Geographic region †	Bachelor's degrees			Master's degrees		Terminal master's		Doctorates
	Institution type*			Institution type*		Institution type*		Institution type*
	I	II	III	II	III	II	III	III
New England	115	18	376	1	104	0	75	193
Mid. Atlantic	342	84	362	8	157	28	98	212
E.N. Central	328	163	313	29	142	65	103	186
W.N. Central	229	77	104	8	26	14	32	57
S. Atlantic	193	67	251	10	66	25	47	137
E.S. Central	78	18	74	6	13	19	23	17
W.S. Central	109	58	171	15	36	31	37	87
Mountain	60	16	185	2	21	0	43	60
Pacific	247	103	348	16	154	44	72	162
Subtotal	1701	604	2182	95	719	226	530	1111
Total		4487		814		756		

* *"Institution type" indicates the highest physics degree offered; type I—bachelor's degree, type II = master's degree, type III = doctorate.*

† *See Table IV for explanation of geographic region.*

Table VIII offers details of where physics degrees are granted and by what types of institutions. To distinguish between degree recipients who enter the job market and those who stay in school the total number of master's degrees was divided into terminal master's degrees and those granted enroute to a higher degree. Thus **Table VIII** shows that only 30% of the master's degree recipients from master's institutions intend to work toward a doctorate, while almost 60% of the new masters at doctorate institutions continue their studies toward a PhD. Since 1973 the master's degrees leveled off between 800 and 900 while the terminal master's degrees declined steadily.

In response to the numerous requests we get for minority data we asked each chairman to identify the following minority degree recipients: blacks and all other minorities as defined in the footnote for **Table IX.** To provide a frame of reference for the number of minority degree recipients **Table IX** lists the total number of physics degrees granted; thus slightly less than 2% of the new physics bachelors are blacks and slightly more than 2% of them are members of other minorities. Last year's proportions were similar. A look at the geographic distribution of all physics bachelor's degrees granted shows that the two southern regions South Atlantic and East South Central grant only 15% of all physics bachelor's degrees, but 41% of those granted to blacks. As the total number of physics degrees granted at all levels declined annually, so did those granted to minority groups with one exception—the number of terminal master's degrees conferred on "other minority" graduates; 70 out of 756 in 1975-76 compared with 57 out of 849 in the previous year.

The last row of **Table IX** shows the number of women for each degree level and minority group. While women comprise a slowly increasing percentage of the graduates at the bachelor's level, their percentage at the doctorate level declined from 4.5% to under 4% in one year.

Table IX. Number of physics degrees granted to minorities, by geographic region and sex, 1975-76.

Geographic region †	Bachelor's degrees			Master's degrees			Terminal Master's degrees			Doctorates		
	Total	Black	Other *minorities	Total	Black	Other *minorities	Total	Black	Other *minorities	Total	Black	Other *minorities
New England	509	9	8	105	2	8	75	1	10	193	0	17
Mid. Atlantic	789	14	16	165	2	12	126	3	6	212	1	25
E.N. Central	803	9	6	171	0	8	168	0	14	186	1	15
W.N. Central	410	3	4	34	1	1	46	0	1	57	0	6
S. Atlantic	511	22	3	76	0	1	72	4	10	137	2	7
E.S. Central	170	13	3	19	0	0	42	1	2	17	0	2
W.S. Central	338	8	6	51	0	7	68	0	7	87	0	12
Mountain	261	0	3	23	0	5	43	0	4	60	1	6
Pacific	696	8	43	170	6	7	116	1	16	162	3	23
Total	4487	86	92	814	11	49	756	10	70	1111	8	113
Men	4096	76	73	762	10	43	688	10	53	1067	6	106
Women	391	10	18	52	1	6	68	0	17	44	2	7

* *Other minorities include: American Indian, Mexican American, Puerto Rican, Asian Indian and Oriental students.*

† *See Table IV for explanation of geographic region.*

ASTRONOMY

When undergraduates are faced with satisfying a science-degree requirement, introductory astronomy is a popular choice. On the other hand, the number of astronomy degrees conferred each year is small when compared with other disciplines. Only 73 departments granted astronomy degrees in 1976–77 according to AIP's Survey of Enrollments and Degrees; 52 of those 73 departments offer graduate degrees in astronomy.

In view of how recently the astronomy survey was started, the variation in the number of departments that contribute data to the survey from year to year should not be surprising. Several combined physics and astronomy departments have degree-granting astronomy programs on their books but no students enrolled in a given year. Thus, with a varying number of contributors and a short period of time it is clearly difficult to determine the direction of enrollment and degree trends. **Table X** attempts to identify trends in astronomy enrollments and degrees by singling out 47 consistently reporting departments. From the data shown in **Table X** one can conclude that enrollments both at the undergraduate and graduate levels have declined since 1973 and appear to be leveling off.

With a larger number of astronomy departments contributing data in 1976–77 than in the previous year the introductory enrollment increased 6% to 29 334; however, this total represents only a small proportion of the total number of students enrolled in introductory astronomy courses because **Table XI** includes only institutions that grant astronomy degrees.

Table XII presents the same data as **Table XI**, adds degree information and divides the most recent enrollment and degree data by type of highest astronomy-degree-granting department. **Table XII** also shows the degree data by sex and that a higher proportion of women are included among the astronomy degree recipients than among new physicists.

Table X. Four-year trend in astronomy enrollments and degrees, 1972–77*

Astronomy degrees	1972–73	1973–74	1974–75	1975–76
Bachelor's	131	149	136	134
Master's	51	48	66	39
Terminal master's	28	31	23	28
Doctor's	79	60	68	83

Astronomy enrollments		1973–74	1974–75	1975–76	1976–77
Introductory courses for science majors		1837	1746	2041	2136
Introductory courses for nonscience majors		17781	17851	17739	18722
Total introductory enrollment		19618	19597	19780	20850
Junior astronomy majors		265	283	241	196
Senior astronomy majors		222	181	206	203
First-year graduate students	U.S.	142	127	111	116
	foreign	14	9	15	9
	Total first-year enrollment	156	136	126	125
Total graduate students	full-time	629	638	577	623
	part-time	58	45	68	33
	Total graduate enrollment	687	683	645	656

* *The numbers in Table X are based on 47 consistently reporting astronomy departments.*

Table XI. Undergraduate and graduate astronomy enrollments, 1976–77

	39 separate astronomy depts. incl. 33 graduate departments	34 combined physics & astronomy depts. incl. 19 graduate departments	Total* 73 depts. incl. 52 graduate departments
Introductory courses for science majors	3522	1192	4714
Introductory courses for nonscience majors	16758	7862	24620
TOTAL INTRODUCTORY ENROLLMENT	20280	9054	29334
Junior astronomy majors	222	62	284
Senior astronomy majors	195	84	279
First-year graduate students: U.S.	118	30	148
First-year graduate students: foreign	8	5	13
TOTAL FIRST-YEAR ENROLLMENT	126	35	161
Total graduate students: full-time	609	143	752
Total graduate students: part-time	41	19	60
TOTAL GRADUATE ENROLLMENT	650	162	812

* *These totals show the enrollment at degree granting astronomy departments only.*

Table XII. Astronomy+ enrollments 1976–77 and degrees 1975–76 by type of institution*

No. of institutions:	Type I 21		Type II 8		Type III 44		Total 73
1975–76							
Astronomy degrees	Men	Women	Men	Women	Men	Women	
Bachelor's	24	5	13	–	115	20	177
Master's	–	–	1	–	47	5	53
Terminal master's	–	–	4	–	28	3	35
Doctor's	–	–	–	–	81	8	89
1976–77							
Astronomy enrollments							
in introductory courses for science majors	596		780		3338		4714
in introductory courses for nonscience majors	2916		1239		20485		24620
Number of undergraduate astronomy majors							
juniors	39		48		197		284
seniors	46		45		188		279
Number of graduate astronomy students							
First-year: U.S.	–		9		139		148
First-year: Foreign	–		1		12		13
Total: full-time	–		29		723		752
Total: part-time	–		3		57		60

* *"Institution type" indicates the highest astronomy degree offered; type I = bachelor's degree, type II = master's degree, type III = doctorate.*

\+ *This survey includes only degree-granting astronomy departments.*